

I. Amendment to the Claims

Claims 1-26 are pending in the present application. Please cancel unelected Claims 14-23. Please amend Claims 2-4, 7-9, 11-12 and 26 as set forth below. This version and listing of the claims replaces all prior versions and listings of the claims.

1. (original) A method for reducing metal diffusion in a semiconductor device, comprising:

forming a copper containing metal portion over a substrate;
forming a silicon carbon nitro-oxide (SiCNO) layer on the copper containing metal portion;

depositing a first dielectric layer over the SiCNO layer; and
generating an opening in the SiCNO layer and the first dielectric layer for a connection metal portion to be connected to the copper containing metal portion,

wherein the SiCNO layer reduces the diffusion of the copper containing metal portion into the first dielectric layer.

2. (currently amended) The method of claim 1 wherein the forming a SiCNO layer step is performed in a PECVD chamber.

3. (currently amended) The method of claim 1 wherein the forming a SiCNO layer step ~~further~~ includes:

depositing a Si based precursor layer; and
exposing the precursor layer to predetermined gases providing C, N, and O elements to form SiCNO.

4. (currently amended) The method of claim 3 wherein the predetermined gases include $\text{SiH}(\text{CH}_3)_3$ ~~or $\text{Si}(\text{CH}_3)_4$~~ , CO_2 or O_2 , and NH_3 .

5. (original) The method of claim 3 wherein the SiCNO is formed under a pressure between 2 and 4 Torr with a temperature between 325 and 400 °C.

6. (canceled)

7. (currently amended) The method of claim 1 wherein the generating step further includes:

etching the first dielectric layer and the SiCNO layer to form a trench region and a via region; and

depositing the connection metal portion into the trench and via regions.

8. (currently amended) The method of claim 7 further including the step of ~~includes~~ forming a sealing SiCNO layer on top of the deposited connection metal portion and the first dielectric layer.

9. (currently amended) The method of claim 7 further including the step of ~~includes~~ forming a sidewall SiCNO layer on the sidewalls of the via and trench before depositing the connection metal portion.

10. (original) The method of claim 1 further comprising:

reducing the first dielectric layer to a predetermined thickness;

depositing a SiCNO based etch stop layer on top of the reduced first dielectric layer; and

depositing a second dielectric layer on top of the etch stop layer.

11. (currently amended) The method of claim 10 wherein the generating step includes ~~further comprising~~:

etching the first and second dielectric layers and the SiCNO based etch stop layer to form a trench region and a via region; and

depositing the connection metal portion into the trench and via regions.

12. (currently amended) The method of claim 11 further including the step of ~~includes~~ forming a sidewall SiCNO layer on the sidewalls of the via and trench before depositing the connection metal portion.

13. (original) The method of claim 10 further comprising depositing on top of the connection metal portion a sealing SiCNO layer that seals the connection metal portion and the second dielectric layer thereunder.

14-23. (Canceled)

24. (original) A method for reducing copper diffusion in a semiconductor device, comprising:

- depositing a copper containing metal layer on top of a substrate;
- depositing a Si based precursor layer on top of the copper based metal layer;
- exposing the precursor layer to predetermined gases to form a silicon carbon nitro-oxide (SiCNO) layer;
- depositing a first dielectric layer on top of the SiCNO layer;
- reducing the first dielectric layer to a predetermined thickness;
- depositing a SiCNO based etch stop layer on top of the reduced first dielectric layer;
- depositing a second dielectric layer on top of the etch stop layer;
- etching the first and second dielectric layers and the SiCNO based etch stop layer to form a trench region and a via region;
- depositing a predetermined metal into the trench and via regions to contact the copper based metal layer;
- wherein the SiCNO layer prevents the diffusion of the copper based metal layer into the first dielectric layer.

25. (original) The method of claim 24 further comprising depositing on top of the trench a sealing SiCNO layer that seals the trench and second dielectric layer thereunder.

26. (currently amended) The method of claim 24 further comprising forming a sidewall SiCNO layer covering the sidewalls ~~sidewals~~ of the trench and via regions.